We claim:

1. A method for measuring the rise time of an x-ray pulse, comprising: $providing \ a \ dielectric \ material \ that \ has \ a \ material \ property \ of \ having$ zero effective reflectance at a wavelength λ_1 directed onto said dielectric material;

directing an x-ray pulse onto an area of said dielectric material to produce a reflectivity change in said dielectric material, wherein said x-ray pulse has sufficient energy to alter the reflectivity of said dielectric material at said wavelength λ_1 , wherein said reflectivity changes from a minimum to a maximum;

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directing a polarized probe beam at wavelength λ_1 onto said area of said dielectric material as said reflectivity changes to produce a reflected beam, wherein said reflected beam will be reflected at an intensity that is a function of said reflectivity change over time; and

detecting and recording the intensity change as a function of time, wherein said intensity change as a function of time corresponds to the rise time of said x-ray pulse.

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- 2. The method of claim 1, wherein said wavelength λ_1 is directed at Brewster's angle of incidence onto said dielectric material at p-polarization, wherein said x-ray pulse has sufficient energy to alter the Brewster's angle reflectivity of said dielectric material at said wavelength λ_1 , wherein said p-polarized probe beam is directed at said wavelength λ_1 at Brewster's angle of incidence onto said area of said dielectric material as said reflectivity changes to produce said reflected beam.
- 3. The method of claim 1, wherein said dielectric material comprises a diamond plate.
- 4. The method of claim 1, further comprising encoding time-related information spatially onto said probe beam.
- 5. The method of claim 1, further comprising encoding a linear gradient of arrival times on said probe beam by orienting said dielectric material at an angle relative to said x-ray pulse.

- 6. The method of claim 1, wherein the step of detecting comprises imaging said reflected beam onto a CCD detector array.
- 7. The method of claim 1, wherein the step of detecting comprises imaging said reflected beam onto a film.
- 8. The method of claim 1, wherein said dielectric material is selected from the group consisting of z-cut alpha quartz (SiO_2) and z-cut sapphire (Al_2O_3).
- 9. The method of claim 1, wherein time-varying reflectivity information is imprinted on both the transmitted and reflected beams.
- 10. The method of claim 1, wherein said dielectric crystal comprises an antireflection coating.
- 11. An apparatus for measuring the rise time of an x-ray pulse, comprising:
- a dielectric material that has a material property of having zero effective reflectance at a wavelength λ_1 directed onto said dielectric material;

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means for directing an x-ray pulse onto an area of said dielectric material to produce a reflectivity change in said dielectric material, wherein said x-ray pulse has sufficient energy to alter the reflectivity of said dielectric material at said wavelength λ_1 , wherein said reflectivity changes from a minimum to a maximum;

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means for directing a polarized probe beam at wavelength λ_1 onto said area of said dielectric material as said reflectivity changes to produce a reflected beam, wherein said reflected beam will be reflected at an intensity that is a function of said reflectivity change over time; and

means for detecting and recording the intensity change as a function of time, wherein said intensity change as a function of time corresponds to the rise time of said x-ray pulse.

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12. The apparatus of claim 11, wherein said means for directing a polarized probe beam is adapted to direct wavelength λ_1 at Brewster's angle of incidence onto said dielectric material at p-polarization, wherein said means for directing an x-ray pulse is adapted to provide sufficient energy to alter the Brewster's angle reflectivity of said dielectric material at said wavelength λ_1 , wherein said p-polarized probe beam is directed at said wavelength λ_1 at Brewster's angle of incidence onto said area of said dielectric material as said reflectivity changes to produce said reflected beam.

- 13. The apparatus of claim 11, wherein said dielectric material comprises a diamond plate.
- 14. The apparatus of claim 11, wherein said probe beam is spatially encoded with time-related information.
- 15. The apparatus of claim 11, wherein said dielectric material is oriented at an angle relative to said x-ray pulse to encode a linear gradient of arrival times on said probe beam.
- 16. The apparatus of claim 11, wherein said means for detecting comprises a CCD detector array onto which said reflected beam is directed.
- 17. The apparatus of claim 11, wherein the means for detecting comprises a film onto which said reflected beam is imaged.
- 18. The apparatus of claim 11, wherein said dielectric material is selected from the group consisting of z-cut alpha quartz (SiO_2) and z-cut sapphire (Al_2O_3).

- 19. The apparatus of claim 11, further comprising a transmitted beam that comprises the reciprocal intensity of said reflected beam, wherein both said transmitted beam and said reflected beam comprises time-varying reflectivity information.
- 20. The apparatus of claim 11, wherein said dielectric material comprises an antireflection coating.

- 19. The apparatus of claim 11, further comprising a transmitted beam that comprises the reciprocal intensity of said reflected beam, wherein both said transmitted beam and said reflected beam comprises time-varying reflectivity information.
- 20. The apparatus of claim 11, wherein said dielectric material comprises an antireflection coating.